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Guidebook for New Principal Investigators

Advice on Applying for a Grant, Writing Papers, Setting up a Research Team and Managing Your Time

Institute of Genetics, CIHR

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Canadian Institutes of Health Research
Instituts de recherche en santé du Canada
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To Lou Siminovitch, a great mentor.

The authors are tremendously grateful to Jennifer Jennings for her important contributions to the creation of this Guidebook. First, we thank her for motivating the authors to undertake the painful task of transforming a series of lectures into this Guidebook. And second, we thank her for her enthusiastic forbearance of a seemingly endless number of revisions, for her many long hours of editing and formatting, and for her numerous thoughtful suggestions.

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About This Guidebook

This guidebook is intended for all researchers (new and experienced) who write grant applications in any area of health research, including basic biomedical research, clinical research, the social sciences and the humanities.

This guidebook provides tips about:

- applying for a grant as a Principal Investigator (PI)
- writing papers
- building and managing your research team and laboratory
- managing your time

Obviously, these tips are only suggestions, not universal rules. However, these tips are from successful senior scientists who are extremely—and perhaps even overly!—familiar with applying for grants, managing research teams, and running research laboratories:

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The advice in this Guidebook was initially compiled for the first Institute of Genetics New Principal Investigators Meeting, in November 2002. The high level of interest in this subject, from the new PIs attending this meeting, led to the development of this Guidebook.

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The Top Eight Things to Do to Write Great Grants

Don't even think about doing anything else but these things!

Good grant writing is formulaic, and a learned skill. Some people are naturally better at it, but you can learn to be just as good. So, follow the formula! It's not magic or inspiration at midnight. Obviously, one can successfully deviate from this formula, but it is a formula that works—so it's a great beginning.

1. Organize an Internal Peer Review Panel

This is the number one thing to do, by far. Even if your institution doesn't require an internal peer review, our strong advice is to organize an Internal Review Panel with three colleagues, ideally 10–14 days before the grant deadline. The panel should meet with the PI to review the grant as a team (a key feature, see below). The Research Institute of Sick Kids (The Hospital for Sick Children) has required this practice for more than 25 years and the grant isn't signed off by the Director of the Institute until the internal review has been done. The internal review is invaluable for:

1. Tremendously improving the PRESENTATION AND THE SCIENTIFIC CONTENT of the grant. That this process invariably improves grants is true for even the most hardened veterans of the grants wars.
2. Increasing COLLEGIALITY within the institution. Your colleagues get a better idea of what your research is all about. Intra-institutional collaborations frequently emanate from these reviews.
3. Giving PIs invaluable EXPERIENCE IN REVIEWING grants. In turn, this helps improve their own grant writing.
4. Making you finish your grant application long BEFORE THE DEADLINE. In fact, this is one of the major advantages.
5. Creating institutional TEAM SPIRIT. The value of this can't be overestimated. You quickly realize that we all find writing a compelling, clear grant to be tough, and that eases the pain.

Panel structure.
The Internal Review Panel should be composed of two researchers who work in the same field as the applicant, with at least one additional reviewer from outside the field—thus simulating the reality of a typical peer review panel. Since it is much easier to criticize someone else's grant than to write one yourself, your colleagues will always have something to say. You will never get it perfect for this internal review (or at least none of the authors of this Guidebook ever have, in over 50 person-years of grant writing!).

The process.
Reviews generally take at least 90 minutes. One of the three reviewers acts as the Chair. The Chair first invites general comments from all three reviewers. This part of the review is often the most important, and focuses on the summary pages, the overall quality of the writing and research proposal, and the big problems. Subsequently, the three reviewers go through the grant page by page with the applicant, to discuss more specific issues. At the end, the reviewers give the applicant their marked-up copies that highlight small details that needn't be discussed at the review itself.

Avoid this mistake.
There is no adequate substitute for an Internal Peer Review Panel, *meeting together with you*. Having two or three colleagues independently read your grant application, and then give you feedback on an individual basis, is not nearly as effective as an Internal Peer Review Panel. First, they rarely do it as conscientiously as when they are part of an internal review process. Second, and more importantly, a very constructive synergy develops among the reviewers that invariably improves the quality and richness of the feedback.

Note: When you try to implement this practice at your own institution, your colleagues will invariably and predictably have 206 reasons why they don't want to set up this system. None of those reasons are valid. Yes, it takes time, but everyone benefits altruistically. Just do it!!!

If you would like a copy of the Sick Kids Research Institute Internal Grant Review form, please email Jennifer Jennings at jennig@sickkids.ca

Another good example of a review protocol is to be found in the Internal Peer Review Form from the University of Alberta Faculty of Medicine and Dentistry at http://www.med.ualberta.ca/research/reviewform.pdf

2. Start Writing Early

Start the preparation for your grant application at least three months before the deadline, by writing the overall research goal and specific research aims. Why so early? Doing so focuses your reading and thinking, and allows you to plan, seek advice and collaborations, and identify topics you need to read up on. You can't do many of these things well in the last weeks before the deadline—at that late point, you will be concentrating on the writing. It is very likely that your initial *Specific Aims* will change as you continue to write, and an early articulation of them forces you to focus and to think clearly.

GRANT APPLICATION TIMELINE

12 wks before deadline	Write the Overall Goal and each Specific Aim. Start gathering accompanying documents. Aim to have these in hand four weeks before the deadline.
6 wks before deadline	Start writing, a little every day.
3 wks before deadline	Give the draft to the Internal Peer Review Panel.
2 wks before deadline	Meet with the Internal Peer Review Panel.

3. Write Daily

In preparing a grant application, it is a good idea to commit to writing part of the grant every day. Begin the actual writing at least 6 weeks before the Internal Peer Review Panel deadline.

> Researchers who write daily, even 30 minutes/day, are much more productive and successful than those who leave it all to a last-minute cataclysmic effort.

4. Finish the "Junk" in Month One (but not only the junk)

All the accompanying documents—CV module, letters of collaboration, collaborative details, references, cost quotes—take a lot of time to obtain or complete, and generally much more time than you think (often several weeks). Get them done early. Put the references into EndNote® or Reference Manager® right from the start.

5. Tips for Good Grant Writing

Write an application that the reviewers will enjoy reading. Aim for nothing less. Remember, the reviewers are wading through up to 14 other grant applications, so make yours clear, thoughtful and interesting. Good writing reflects clear and precise thinking. In fact, writing generally forces clear and precise thinking:

"Writing maketh an exact [woman] man".
–Sir Francis Bacon

Getting the style, unconsciously.
Get copies of a couple of very highly rated (i.e., successful) grants from PIs in your institution, or somewhere else, preferably PIs at the same career level as yourself. Before you write a particular section of your grant, read those others to pick up the 'rhythm' of really good grant writing. To get the rhythm of excellence and clarity, always read a few paragraphs of a few good *Nature* "News and Views", and one of the papers of Tom Jessell (Columbia) in *Cell*, which are models of clarity and beautiful scientific style. (It matters not that you may not be a neuroscientist, like Jessell).

Get it down! Don't be a sentence "caresser".
Word processors encourage the endless reworking of a sentence, to get it 'perfect'. Don't do this. It is a time waster that creates the illusion of effective progress. To generate a well-written grant, follow these four steps:

1. Get it *down*, even rough, ugly, too long and incomplete.
2. Get it *right* (factually correct, balanced).
3. Get it *pretty*. Now is the time to do some sentence caressing.
4. Get it *out*!

Good expository writing has two predominant features.

1. Begin each paragraph with a great lead sentence. A strong lead sentence is interesting and says what the paragraph is about. It is worth spending time on, even in the first ugly draft, since it defines the rest of the paragraph. One should be able to get the idea of most of a grant—or a paper—by reading the lead sentences alone. Try it with a Tom Jessell paper—it works!

2. The remainder of the paragraph should elaborate on the topic defined by the lead sentence. The content of the remainder is generally less important than that of the lead sentence. Thus, a good paragraph has an inverted pyramid structure, as shown.

A very common error is to have a rousing concluding sentence that is often, when slightly reworked, a superb lead sentence.

Who is the audience?

What types of PIs are on the panel? Almost all grants panels, including CIHR panels, are generally very heterogeneous. Therefore, you are usually writing for intelligent researchers who are not expert in your area, except for maybe two to three panelists who will know more. You have to write with simple clarity for the majority, but also convince the two to three experts that you really know your stuff. "Who is my audience?" is the number one issue in grant writing, just as it is in giving a talk.

Give the BIG picture, don't drown the reviewer in details, and state rationales.

Three of the most common weaknesses in grant applications are:

1. Failure to give the big picture (why should the reviewer care?)

2. To drown the reader in details (the reviewer doesn't want to know). Some details may be critical, but the application doesn't need equal detail everywhere. Excessive detail is usually just an inappropriate way by which the applicant is trying to reduce anxiety.

3. Failure to state rationales: *why* do these experiments need to be done.

Use illustrations.
Use illustrations, figures and boxed texts to help the reader easily see the big picture. Nothing is more depressing to a reviewer than to see pages of dense text unalleviated by something visual. In-text illustrations do not count toward the total page numbers of CIHR grants. Illustrations help the reviewer grasp background information, be convinced of the strength of your preliminary data, and acquire a quick overview of your Research Plan.

Use the first or third person.

Instead of..."The samples will be analyzed for traces of..."

Use..."I will analyze the samples for traces of..."

Instead of..."This result is an affirmation of Rachubinski's theory..."

Use..."This result affirms Rachubinski's theory..."

Note: NEVER reduce your font below Times 12, or have less than 1" margins.

6. Actually Writing the Application

The structure of a typical operating grant is shown in Figure 1 on the opposing page. However, you should write the different parts of the application in the order that is shown.

We suggest that you write the Research Plan before the Background section, since your Research Plan will indicate to you what Background information you should include. Otherwise, one often ends up writing Background that is ultimately irrelevant to the Research Plan. However, the very first thing you should write is an initial rough draft of the one page Summary of the Research Proposal. By doing so, you force yourself to focus on what you really want to investigate, and to develop a draft structure of your Research Plan.

Summary of the Research Proposal Page

This is the "seduction" page, in which you generate credibility (or not). If you write this page (and the Summary of Progress) well, then the reviewer is on your side. If you write this page poorly, the reviewer is already alienated, your chances of ranking highly will be eroded, and you will be at a huge disadvantage before you start!

Initially, a rough and ugly Research Plan is just fine. Remember, the first critical goal is to "Get it *down.*"

The objectives of this summary page are to:

Generate interest. Get the reviewer interested in the research question.

Demonstrate importance. Convince the reviewer of the importance of your work.

Give concise Specific Aims and an overview of each part of the Research Plan. Present a lucid, precise overview of the Research Plan that is well founded both on your experience and on that of the literature. In basic biomedical and clinical science, indicate that you know what the expected results are (and that you have a 'Plan B' if needed—but Plan B shouldn't be given much space, only recognition).

In social science and humanities research, you will want to point out how and why your project will complement previous research, rather than simply building on the existing literature.

Develop a timeframe. Outline your timelines at the end of the section of the Research Plan that discusses each Specific Aim. Only a few words are needed.

FIGURE 1

STRUCTURE OF A GRANT APPLICATION (IN CIHR GRANTS)	ORDER OF WRITING THE SECTIONS OF THE APPLICATION
Summary of Research Proposal (1 page)	**Summary of Research Proposal**
Summary of Progress (1 page)	**Summary of Progress**
Research Proposal	**Research Proposal**
Background (approximately half the alloted pages) • General background - the literature with your published work cited • Your preliminary results • Rationale	**Research Plan** ↓ **Background and Preliminary Results** *Write the Research Plan before the Background section, since your Research Plan will indicate to you the background information you should include.*
Research Plan (approximately half the alloted pages) • General Objective and Specific Aims • Specific Aim 1 Proposed Research Expected Results Difficulties Anticipated Timeline • Specific Aim 2, etc.	
Significance (a short paragraph)	**Significance**

The layout of this Summary Page.

Setting the stage
(about 1/3 of the Summary Page).

Give a few introductory sentences that set the general (biological/health/social) stage, and then the research stage. The level here should be comparable to a "News and Views" in *Nature*.

For example:
"The development of the brain is one of the most complex biological processes known. Each neuron in the brain contacts about 1,000 other neurons, but the molecular mechanisms by which axon guidance and synapse formation are regulated are poorly understood. Nevertheless, a number of inherited disorders have been shown to be associated with defective axon guidance."

Next, present the General Objective and Specific Aims of your research proposal. In general, you will want to have only three to four Specific Aims. A hypothesis may not be required if it is implicit, or if the research is not hypothesis-driven.

"The General Objective of our research is to identify critical regulators of..."

"To attain this objective, we have three Specific Aims:..." State them now.

Proposed research
(about 2/3 of the Summary Page).

A commonly ignored yet essential component of this Summary Page is to state WHY you are undertaking the proposed research, or a particular experiment. You can force yourself to give the rationales by using the wording illustrated in the examples below:

"To identify molecular regulators of axonal guidance, we will..." or

"To establish what family members think about genetic testing, we will..."

Then, state WHY you are using a specific strategy:

"Our approach will be to identify homologues of CUB domain proteins expressed in the developing brain, since proteins of this class have been shown to..." or

"The research is designed to produce replicable empirical data about the social ramifications of genetic testing."

Significance of the work
(a short paragraph).

It is imperative to make your case well.

For example:
"This work will enhance your understanding of the biology of... and to provide a foundation for elucidating [disease category]". Make a disease link, if possible.

Summary of Progress Page

Even if the application is new, it is useful to summarize your previous work and progress achieved, for example, during post-doctoral training, in the Summary of Progress Page. This summary page should cite briefly your core findings and lead naturally to the major research questions that you will investigate in the proposal.

The Research Plan—approximately half the allotted pages

Begin with a short paragraph summarizing points that were probably made earlier in the *Background*, but which can always bear brief repetition for a tired reviewer. Thus, state where both (i) current knowledge, and (ii) your preliminary/previous work have led you. If you want to put in a "Rationale" paragraph, this is the place for it. Rationale paragraphs can be useful in indicating why you are particularly well equipped to tackle the proposed research, why the question is compelling, and why your approach is ideal.

As part of the introduction to the Research Plan, restate the General Objective and Specific Aims.

Key points in writing the Research Plan:

- Write the Research Plan around each Specific Aim.
- For each Specific Aim, state the Expected Outcomes, Potential Problems and Alternative Strategies, Techniques and Timelines.

  What will your experiments tell you, and why is that outcome particularly important to obtain? For example, "These studies will define the role of (your favourite protein) in (your favourite biological activity). More generally, this work will identify the major interacting partners of (your favourite protein), providing the first link between (whatever you are studying) and (whatever you want to link it with)".

- Don't propose 13 approaches to doing something. Clearly identify your NUMBER ONE preferred method or strategy to achieve a Specific Aim, and justify your preference. At the end of that paragraph/section, indicate that, "If this approach unexpectedly proves to be unsuccessful, we will use the method of Brenda Rachubinski, which has also been demonstrated to be effective (Ref)."

In identifying potential problems, and alternative strategies that you will employ if those problems are encountered, be relatively brief. You mainly want to show an awareness of the problems that may arise, and of the alternative approaches that can be used if the problems do indeed occur.

Timelines: Briefly state the estimated time, in months, required for each Specific Aim.

Background and Preliminary Results—approximately half the allotted pages

In an introductory paragraph or two give the bird's eye view, a brief overview of the field and why this area of research is important. What are the big questions? For example, "The major question in inherited neurodegenerative diseases is why a neuron born with a mutant gene takes years to decades to die." OR "With regard to genetic information, a major ethical and legal question concerns the extent to which an individual's right to privacy and confidentiality can be overridden by the rights of family members to be apprised of genetic information that could have direct consequences for their health."

Next, write the rest of the Background to provide the necessary excitement and information to make your Research Plan appear appropriate and brilliant. Thus, you should be conscious of why you are providing each bit of background information. This is the reason for writing the Research Plan first. In your Background and your presentation of your preliminary results, you want to lead the reader up to your Research Plan so that they actually sense what you will be proposing before they have read the Plan.

Significance—a short paragraph at the end of the grant

This paragraph is obligatory and expected, but frankly, the significance of your research should be apparent right from the first sentences of your Summary of Research Proposal. This paragraph is a good place to bring out some additional implications of your work, and to sketch a brilliant future for the area of your research.

7. Number of Grants, External Reviewers

Do not apply for a grant until your track record will support it. For example, if you have one CIHR grant but haven't published any or many papers as an independent PI yet, don't apply for another CIHR grant until you have those papers.

In general, submitting two grants to one panel is a problem, unless you KNOW that they are both terrific, and unless you have a track record that has demonstrated that you can do the research for both. The panelists will be doubly unhappy to be reading two grants from one applicant if one (or both) is/are weak.

In choosing external reviewers, choose people known to be fair and respected, rather than your buddy. In general, don't suggest new PIs as externals—they tend to have 'young faculty' syndrome, which makes them excessively critical.

8. Apply for an Appropriate Budget and Term

Justify your budget. If you can, link specific personnel to Specific Aims. Some committees spend much of their time looking at the budget and its justification.

Keep your budget reasonable. For example, it's generally acceptable to ask for:

- one technician, or one research assistant
- one or two graduate students, and
- for lab-based research, $15,000 per person-year in supplies and general operating costs for each member of your research team who is at the bench.

If you are requesting funds for a post-doc or summer student, it is much more convincing if you have a specific individual in mind.

Apply for a three-year grant. Reviewers rarely give longer-term grants to new PIs.

Before submission.

Before submitting your grant, create a checklist of all the points on grant writing, and go through your application—as you write and review it—to be sure you have followed the above guidelines. Please note, however, that the authors of this Guidebook will want to claim some credit when you are funded, but will deny any responsibility if you are not!

The Role of Your Previous Supervisor

In your grant application, try to dissociate your research program from that of your previous supervisor. However, this may not be entirely possible, and it may be especially difficult for basic biomedical scientists who are bringing technologies from their previous supervisor. In that case, cite your previous supervisor in your grant application, where appropriate.

A positive letter of reference from a previous supervisor can be very influential with the review committee—particularly if the letter describes how your research program is distinct from that of the supervisor.

If You Didn't Get Funded

1. Above All, Don't Get Discouraged

You are not alone. Even great researchers have grant applications rejected. At CIHR, about 50% of applicants are ultimately funded by their third submission of a grant. If you are still not funded after that third submission, then your proposal is likely to have substantial flaws, or is relatively uninteresting compared to the competing grants. After the first rejection, don't wait: seek the advice of an experienced congenial mentor.

2. High-Risk High-Benefit Research

If your grant was well written and the science is beautiful, and you still weren't funded, it is possible that you are ahead of the wave, and that the panel either didn't "get it" or, more commonly, that the risk-benefit ratio of the proposed work is unfavourable in their view, particularly when compared to other excellent, less risky but high-benefit applications. If the latter is the case, try to persuade your department Chair to give you some start-up funding to proceed, and also consider applying to the Institute of Genetics Request for Applications entitled "New Discoveries: High-Risk High-Benefit Grants".

http://www.cihr-irsc.gc.ca/e/13147.html

3. Listening to Your Reviewers

Try to listen to what the reviewers are saying. Specific negative comments in individual reviews can appear, misleadingly, to carry more weight than the whole panel gave to that particular point. On the other hand, don't use the praise in reports from external reviewers to mentally dismiss the concerns of the whole panel, as articulated in the Scientific Officer's report.

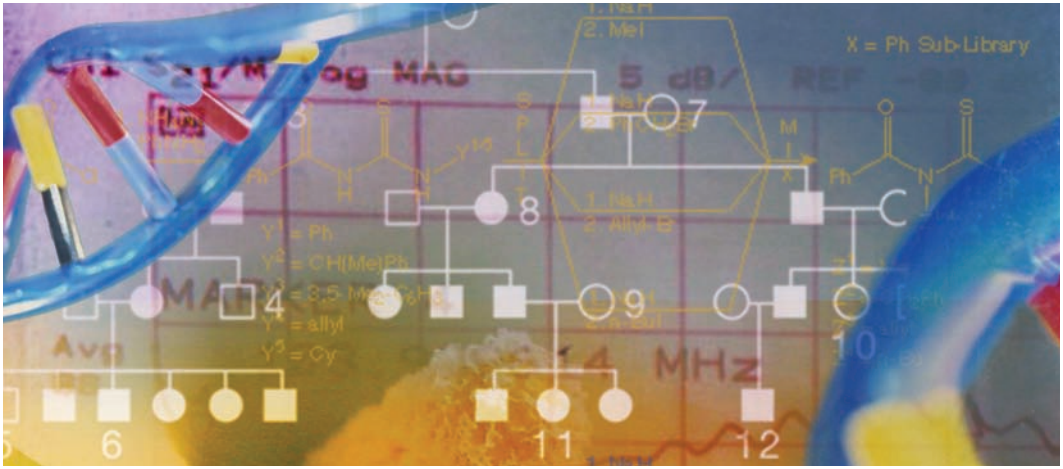
4. Develop a Good Reputation with a Peer Review Panel

In general, stick with the same panel, at least on the first resubmission, even if you worry that they got it wrong the first time you submitted. Be sure it was the panel that got it wrong, and not simply that you didn't like the feedback. Call the grants manager or scientific director of the organization, to confirm your impressions of the reviews, and to be sure the grants panel was the right one. For CIHR, the person to call is the Deputy Director for the grants panel to which you applied.

5. Response to Reviewers' Pages

Be unfailingly courteous and appropriately brief. NEVER imply that the reviewer was incompetent, even if s/he was. Just address the most important criticisms factually and professionally. That approach always impresses a panel and helps you to win them over.

Becoming a grants panelist.
As soon as you can afford the time, and once you are funded, it is useful to be on a grants panel, even an internal one. It will make you feel less paranoid about the process, and make you realize that reviewers are invariably doing their best to be fair and wise. Gaining grant panel experience will also help reinforce good practices, and correct bad ones, in your own grant writing.



The Top Five Things to Do to Write Great Papers

1. Apply the Tips for Good Writing

Once again, use the tips for good writing outlined in Section 5 of The Top Eight Things to Do to Write Great Grants.

2. Unconsciously Imitate Great Style

Before writing a paper, read a couple of papers that are really well written, in the journal to which you intend to submit your manuscript. As indicated above, our favourite papers invariably include virtually any of those by Tom Jessell in *Cell* or *Neuron*. They are beautiful models of how to write a scientific paper. Don't read the whole paper at once. Rather, when you start writing the Results section, go read a Jessell Results section for a few paragraphs. Don't worry that your data may not be as beautiful—that isn't the point! Once you start the Discussion section, do the same thing, and so on.

3. Write Every Day

When they have papers to be written, the most productive researchers write daily as an integral part of their research life, even if only for 30 minutes each day. Cultivating this habit will help to make you much more successful. Writing every day is not only a lot more fun and stress-reducing (i.e., "Wow—I've actually started!"), it also produces a much better product. In addition, for those who do basic biomedical research, clinical research, quantitative research or qualitative research, if you begin to write months before you plan to submit your manu-

script for peer review, you often identify problems or gaps in your data that should be addressed.

4. Order of Writing the Various Parts of a Paper

Overarching guideline: You are telling a single story. Everything you write should be built around that story line. For basic biomedical research, clinical research and empirical research, write the paper in the following sequence:

Figures, figure legends and tables.
Always do these first. If well done, the figures and their legends will present the story *almost* without the rest of the text!

Results.
The results should be a written presentation of the information that is illustrated and documented in the figures and tables, and not a lot more. The text of the Results section should be able to stand by itself, even without the reader looking at the figures and tables.

Begin each paragraph that deals with a new result, with the following words: "To determine..." or, "To define..." or, "To establish whether...", and so on. Don't even dream of doing anything else (usually). However, you may sometimes want to precede that first sentence with an introductory one(s), indicating the issue that was being addressed by the objective stated in your sentence beginning "To determine..." (Small point: use the phrase "In order to..." infrequently. It wears thin quickly).

Other infinitives that are used in Results: To identify, define, test, assess, ascertain, investigate, discover, establish, find.

Common error: putting Discussion in Results. This is to be done only rarely, and only if you are not going to discuss a relatively small point in the Discussion.

Discussion.
In a first brief paragraph, it is often useful to summarize your major findings, but do so in language that is usefully different from the abstract of the paper. In the rest of the Discussion, discuss each of the Results, from two points of view. First, discuss the data itself—what does it mean, what does it allow you to conclude? Second, discuss each result in terms of the bigger picture of the field, of biology and of medicine.

Introduction.
In the first paragraph(s), introduce the big picture underlying your story. In subsequent paragraphs, if you are allowed the space, introduce the specific issues that each of your major results addresses. Sometimes it is difficult to decide whether some background information should go in the Introduction or in the Discussion. In the Discussion, you will often want to provide more context on an issue than you were able to present in the Introduction or in Results.

Abstract.
To write a great abstract, it is very useful to read a few great ones from a current issue of the journal to which you are submitting the manuscript. That is all the guidance you need. Writing a good abstract takes at least one day. In this PubMed® era, your abstract may be the only thing that most people will read, so devote at least a day to it, look at it again a few days later, and have it vetted by a colleague who is not intimately familiar with the work in that manuscript.

Methods.
It doesn't much matter when you write the Methods. Just don't pretend that you have accomplished much by getting them done. You haven't!!! Refer to previous papers for details, when possible. Most journals now allow/encourage you to put most of the details of methods into the Supplementary Information section of a paper, on the Web.

5. Other Important Issues

- Never, ever submit a sloppily prepared manuscript. You will have lost the battle before you have even started.
- Submit to the correct journal. If it's a lovely *JBC* paper, don't send it to *Nature*. However, aim high.
- If you and your colleagues think the paper is really terrific, and it was turned down for the wrong reasons, you can always call the editor, but be VERY polite and deferential, and never combative.
- If that journal still won't re-examine it, then go to another fine journal at the same level. Amazingly, that often works.
- Review for a journal every chance you get, and then do a great job. The editors will begin to develop a favourable impression of you.
- It is foolish to submit a paper without having a colleague look at it first.
- Always suggest reviewers who are respected in the field.

Building and Managing Your Own Research Team

Like most new PIs, you are undoubtedly a bit intimidated by the prospect of having to develop your own research team or set up your own research laboratory.

Reflect on the labs where you have worked in the past. Were those labs well run? What mistakes can you avoid? What successes can you repeat? What practices contributed to a positive and productive work environment?

Your Chair or Director

Try very hard to establish a good relationship with your Chair or Director. This person controls the amount of space and infrastructure available to you, as well as teaching and administrative assignments. In addition, your Chair or Director can provide you with a useful and different point of view on your research program.

Getting Advice

Actively seek mentorship and advice from other more established PIs as you start to establish your research program. Consider doing the following:

- Ask senior colleagues for advice; they are usually happy to provide it.
- Use your institution's mentoring programs to formally connect with a suitable mentor.
- Meet monthly with other junior colleagues or new PIs.

Building Your Team

If you can, contact directly, preferably by phone, all references for technicians, graduate students, etc. At the very least, contact references directly if the reference letter is generic or contains half-hearted recommendations like "This person would work well in the right environment." (This is code for "Call me!").

Technicians

If you are setting up a lab, technicians are usually your first hire, so advertize for them as soon as possible. It is quite all right to hire someone who has just graduated from university. Recent graduates may stay with you longer (thus providing continuity as your lab grows), and they will bring less experiential bias to your lab.

When you interview potential technicians, administer a quiz to assess their experience and expertise. Ask them to describe their strengths and weaknesses, and verify this information with their previous employer. In addition, ask them to describe research projects with which they have been associated. If they can't articulate the background, rationale and significance to you, at a basic level at least, be wary! Evaluate technicians carefully during the probationary period (usually three to six months). Work with them closely. If their work is not satisfactory, let them go. It is always stressful to end someone's contract, but it will be both stressful and much more difficult to dismiss them after the probationary period. If their work is satisfactory, ask them to make a commitment to you for two to three years. Finally, make it clear to them at the beginning that, if they decide to move on, they should give you as much advance notice as possible, preferably 3–6 months, so that their skills can be transferred to their replacement.

Graduate Students

Graduate students require a special kind of commitment on your part. You have an obligation to train and mentor your graduate students to help them reach their full potential in your lab. Your obligation includes recognizing, over time, which students have potential for a career in science, and which are not cut out for the job.

Post-Doctoral Fellows (PDFs)

If you hire PDFs, remember that they should be capable of functioning at a very high level and that they too can be excellent mentors for your graduate students. At the interview stage, ask potential PDFs to give a presentation to a larger group, and ask the group for feedback. PDFs who are competitive for national funding are likely to be a particular asset to your research team.

It is important to discuss with all prospective PDFs the nature of their career goals. If they definitely aim to become a PI after leaving your lab, they should expect to be able to take a project from your lab to start their careers. This issue must be discussed before you hire them, so that their expectations are not unrealistic, and so that you realize that you must give them a project they can "own" once they leave, if they have done good work with you. Not all good PDFs necessarily want to become a PI, in which case an independent project is not an issue.

Mentoring Your Team

Reflect on how your previous supervisor mentored you. Were you mentored well?

Most members of your research team will expect you to mentor them, and that is one of your major roles. If you take this role seriously, you will find that mentoring keen and capable graduate students and PDFs is one of the most rewarding parts of your job.

Some mentoring advice: Adapt to the needs and desires of each student. Every student is different.

Give your students genuine responsibilities and learning opportunities. For example, have your students write the first draft of the paper themselves; have them do the experiment themselves even though you could write the paper or do the experiment better and faster. Then give them feedback to help them improve.

Be a career counsellor. Offer career advice:

- Tell your students what they must do in order to advance along various possible career paths.
- Identify career resources and opportunities.
- Help them network and make contacts in the field.
- Teach them time management skills.

Remember, it is in your interest to have your team members succeed. Not only will you feel personal pride, but peer review panels take into consideration your ability to produce qualified and successful researchers. Sometimes, after a trainee has been in your lab for several years (and often sooner), it will be clear to you that a career as a PI is not likely to be a good career choice for that individual. In this case, you need to recognize where each person's strengths lie, and guide them appropriately.

Managing Expectations

Early on, clarify your lab guidelines, financial rules and expectations. Meet individually with each person on your team every few months and set clear, specific and reasonable expectations. You can usually hold these meetings every six months (although some individuals will require more frequent meetings). In particular, remind your graduate students that you expect more of them than you would of undergraduates. They will have to think independently and creatively, not just master techniques. To motivate your graduate students, consider sending them to conferences to become aware of the intensity of other graduate students' commitment and research achievements.

Similarly, manage your team members' expectations of you: at your six-month meetings, ask your team members what they expect from you for the next six months, and discuss whether you can realistically meet their expectations.

Keeping Your Lab Running Smoothly

Being a PI is a human endeavour. Have an open-door policy for both professional and personal matters. Encourage your team members to come see you. When they do, listen and try to help.

Some team members will be reluctant to consult with you, so maintain a physical presence. If you work in a lab, do some experiments at the bench, especially in the first few years. Keep your eyes and ears open for potential problems and conflicts:

- Is the organizational structure working?
- Are projects in the hands of the appropriate people?
- What is frustrating people?
- Are there personality conflicts?
- Is anyone experiencing a personal problem?
- Be open and honest, but never gossip to one student about another.

Also notice the positive things:

- What are people enjoying?
- Who gets along well with whom?

Try not to hover—especially with your good students. Tell them what to do and then trust them to do it. Generally speaking, your team members want you around occasionally, but not all the time.

Have team meetings every one or two weeks and insist that all team members attend. Use these meetings to:

- Keep everyone up-to-date on all of the on-going research.
- Decide where papers will be published, with whom and when.
- Discuss staff-related issues (five minutes per meeting is time well spent).

- Brainstorm on topics as needed.
- Avoid misunderstandings and promote intra-team communication.

Instill enthusiasm by being enthusiastic yourself. Convey the message that the research team can make a significant contribution to knowledge. (For inspiration, reread your successful grant application!)

Show enthusiasm for your students' individual work and achievements. For example, having celebrations for newly accepted papers will greatly add to morale.

Good lab sociology can be easily damaged by one "bad apple". If a team member behaves inappropriately, it is your obligation, as the PI, to address the problem. The buck stops with you. You will save both time and aggravation by dealing with problems immediately when they arise. Don't just hope they will go away—they will only amplify, affect others in the lab, and get worse. Call team members into your office individually, articulate to them the impact of their behaviour on the lab, and insist that they act professionally (obey rules, behave civilly, meet expectations, etc.). Be friendly but firm. Never, ever become angry. Communicate your expectations that they will modify their conduct.

Be sure to document the incident(s), and what you told the team member. If the problem persists, consider physically relocating people or helping them find a more suitable position.

If you do not know how to handle a human resources problem, consult with the human resources staff at your institution, and make your department head aware of the difficulty. By taking these two actions, you will begin to work towards a solution, and also protect yourself.

It is in your long-term best interest to be supportive and flexible with your team members. Be particularly supportive if they have health problems (e.g., unwarranted or excessive anxiety, depression). If you take care of your team, you will see the positive effects in your research program. Furthermore, you will develop a positive reputation as a good person to work with, and other students will want to train with you.

Managing Your Time

There is more to being a new PI than honour, glory and universal veneration. You will experience significant new demands on your time, particularly with the additional responsibility of running your own research team. You will have to manage your time like never before. Ask yourself, "Is my research program progressing?" If it's not, ask yourself why. The problem may be poor time management.

You MUST say "no" to lower-priority requests. Until you have been a faculty member for five years or so:

- Limit the number of graduate committees you are on.
- Try to avoid sitting on an external peer review panel, unless your operating grant has been renewed once.
- Avoid excessive collaborations where your research is not the main focus: collaborations that are helpful to others but not part of your core research program can dissipate your time, focus, money and energy.
- Do not "chase" publications; focus on quality, not quantity.

Do not try to keep up with the literature completely. It can't be done. Instead, schedule some time each day to read about the most salient issues in your field, and learn to accept that there have been new developments that you don't know about.

Create a workday schedule that reflects your work priorities, and stick to it. If you leave your schedule open-ended, your time will be dissipated on unproductive, lower-priority activities.

In the same way, create a 24-HOUR schedule that reflects your LIFE priorities too, and stick to it. Don't let your work take over your life. Keep work fun by keeping it in its place.

References

Recommended Books

Many university career centres will have copies of the following books.

Barker, K. (2002). At the Helm: A Laboratory Navigator. Woodbury, NY: Cold Spring Harbor Laboratory.

Babbie, E.R., Benaquisto L. (2002). Fundamentals of Social Research. Scarborough, Ont.: Nelson Canada.

Barker, K. (1998). At the Bench: A Laboratory Navigator. Woodbury, NY: Cold Spring Harbor Laboratory.

Bernard, H.R. (2000). Social Research Methods: Qualitative and Quantitative Approaches. Thousand Oaks, California: Sage Publications Inc.

Feibelman, P.J. (1993). A Ph.D. Is Not Enough: A Guide to Survival in Science. Cambridge, MA: Perseus Publishing.

LeCompte, M.D., and Schensul, JJ. (1999). Designing and Conducting Ethnographic Research. London: AltaMira Press, A Division of Sage Publications Inc.

Ramon Y Cajal, S. et al. (1999). Advice for a Young Investigator. Cambridge, MA: MIT Press.

Roskams, J. & Rodgers, L. (Eds.) (2002). Lab Ref: A Handbook of Recipes, Reagents, and Other Reference Tools for Use at the Bench. Woodbury, NY: Cold Spring Harbor Laboratory.

Recommended Web Sites

CIHR Grant Writing Advice Links
http://www.cihr-irsc.gc.ca/e/1465.html

CIHR Grantscraft Video
http://www.cihr-irsc.gc.ca/e/25145.html
This video includes a discussion of CIHR's internal review processes, including its evaluation criteria.

Tips for Writing a Successful CIHR Grant Application or Request for Renewal
http://www.cihr-irsc.gc.ca/e/24550.html

Burroughs Wellcome Career Awards in the Biomedical Sciences Program
http://www.bwfund.org/programs/biomedical_sciences/career_awards_main.html

Howard Hughes Medical Institute
http://www.hhmi.org/grants/individuals/canlatam.html

http://www.hhmi.org/grants/office/international/